

A revision of the Recent Australian species of the turrid genera *Clavus*, *Plagiostropha*, and *Tylotiella* (Mollusca: Gastropoda)

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ABSTRACT

Species of the drilliline genera *Clavus* (16 species), *Plagiostropha* (2 species), and *Tylotiella* (1 species) from Australian waters are revised. Four new species of *Clavus* are described from off Western Australia. *Clavus viduus* (Reeve, 1845) is regarded as a synonym of *C. unizonalis* (Lamarck, 1822). *Clavus lamberti* (Montrouzier, 1860), *C. laetus* (Hinds, 1843) and *C. obliquatus* (Reeve, 1845) and tentatively *C. flammulatus* Montfort, 1810 are recorded from Australia for the first time. *Clavus undatus* (Hedley, 1907) from New South Wales is recorded for the first time from Western Australia. The genus *Plagiostropha* Melvill, 1927 is separated from *Clavus*. Two species are recorded from Australia, one of which is described as new. *Tylotiella pica* (Reeve, 1843) is recorded from the Australian Indian Ocean territory of Christmas Island, but not continental Australia.

INTRODUCTION

The neogastropod family Turridae is the largest of all the molluscan families (Abbott and Dance, 1982), with Kilburn (pers. comm.) estimating that there are over 4,000 Recent species. The only complete revision of Australian turrids is that of Hedley (1922), in which approximately 370 species were discussed. The primary treatments of Australian turrids since Hedley have been those of Laseron (1954), who revised the Turridae of New South Wales, and Powell's (1964; 1967; 1969) revision of Indo-Pacific Turrinae and Turriculinae. A number of Recent turrids were recorded for the first time in Australian waters from the North West Shelf and slope off the north coast of Western Australia by Kosuge (1985; 1986; 1988a; 1988b; 1990). The major works on fossil Australian turrids are those of Powell (1944), Cotton (1947) and Long (1981).

Subfamilial classification in the Turridae has been controversial and there is as yet no agreed classification; recent proposals are those of Powell (1966) and McLean (1971). Alternatively, Bouchet and Warén (1980) considered existing subfamilial classifications to be based on a "more or less random" grouping of species by shell characters, and they did not use subfamilies. Kilburn (1983; 1985; 1986; 1988) contended that any practical subdivision was better than none, and his work has used a subfamilial classification modified from that of Powell (1966) and McLean (1971). The pragmatic approach of Kilburn is used here.

The present paper is the second in a series intended to revise the Australian Recent Turridae not covered by Powell (1964; 1967; 1969). The first paper (Wells, 1990) examined the drilliline (=clavine) genera *Splendrillia* and *Austrodrillia*. The second paper covers all but one of the remaining drilliline genera known from Australia: *Clavus*, *Plagiostropha* and *Tylotiella*. Only the small genus *Iredalea* is not included. *Horaiclavus* has been included in the Drilliinae by various authors, but the only evidence for this is the statement of Oyama (1954) that it has a radula

comparable with *Comitas* and *Inquisitor*, which would place it in the Crassispirinae (Kilburn, pers. comm.).

Generic assignments in the Turridae are as uncertain as classifications at the subfamilial levels (Bouchet and Warèn, 1980). The present work revises Australian taxa at the species level; with few exceptions existing generic assignments are retained. Kilburn (1988) pointed out that some genera are known only from shell characters, and most of the Australian species are known only from dead collected shells. Because of this the assignment of species to genera and the relationships of the genera are tentative and may be changed considerably if live collected material becomes available for examination.

METHODS

Type material has been sought wherever possible from the museum in which it is deposited. Most of the material examined is at the Australian Museum, Sydney. A secondary source has been the Western Australian Museum, Perth. The collections of the Queensland Museum, Museum of Victoria, South Australian Museum and Auckland Institute and Museum have also been examined, but the primary interest in these museums has been type material. Descriptions are based on shells oriented in the traditional way, spire up, with the aperture facing the viewer. Synonymies are not complete; emphasis is given to systematic revisions, the historical literature, references to the species occurring in Australia, and an indication of the overall range of the species in Indo-Pacific localities.

The following abbreviations are used: AIM, Auckland Institute and Museum; AMS, Australian Museum, Sydney; BM(NH), British Museum, Natural History, London; MNHN, Muséum National d'Histoire Naturelle, Paris; MHNG, Muséum d'Histoire Naturelle, Geneva; MV, Museum of Victoria, Melbourne; NM, Natal Museum, Pietermaritzburg; NMNZ, National Museum of New Zealand, Wellington; QM, Queensland Museum, Brisbane; SAM, South Australian Museum, Adelaide; TM, Tasmanian Museum, Hobart; WAM, Western Australian Museum, Perth; ZMA, Zoological Museum, Amsterdam; l, shell length; w, shell width; a, length of aperture

TAXONOMY

Subfamily Drilliinae Morrison, 1966

Drilliinae: Morrison, 1966: 1-2. Cernohorsky, 1985: 60-62. Kilburn, 1988: 172-227. Wells, 1990: 73-117.

Clavinae: Casey, 1904: 123-170. Powell, 1942: 84-120. Cotton, 1947: 1-12. Laseon, 1954: 16-20. Cotton, 1959: 392-393. Macpherson and Gabriel, 1962: 232. Iredale and McMichael, 1962: 77-78. Powell, 1966: 70-95. McLean, 1971: 116-117. Cernohorsky, 1972: 185-190. Cernohorsky, 1978: 152-153. Powell, 1979: 230-235. Long, 1981: 37-41. Sysoev and Kantor, 1989: 205-214.

Diagnosis

Shells small to medium, 6-30 mm, high spired, medium to solid weight, anterior end often truncated. Protoconch paucispiral, smooth, rounded, 2-4 whorls. Up to 8 teleoconch whorls with variable sculpturing, usually strong axial ribs, and/or lighter spiral striae. Sinus on shoulder slope moderate to deep, callused. Outer lip thin to thickened, usually lacking varix. Stromboid notch usually present. Anterior canal truncated, broad, often slightly notched. Operculum present in species where animal is known; obolanceate, nucleus terminal. Radula prototypic; small central

tooth with a single pointed cusp, flanked on each side by a wide pectinate lateral tooth, and a blade-like marginal tooth.

Genus *Clavus* Montfort, 1810

Montfort, 1810: 435. Type (o.d.): *C. flammulatus* Montfort, 1810 = *Strombus lividus* Linnaeus, 1758 = *Clavatula echinata* Lamarck, 1816. Allan, 1950: 192. Cernohorsky, 1972: 185. Cernohorsky, 1978: 152. Hedley, 1922: 254-257. Kilburn, 1988: 181-183. Kuroda and Habe, 1952: 47. Powell, 1966: 70-91. Short and Potter, 1987: 108. Springsteen and Leobrera, 1986: 269-283. Wells and Bryce, 1986: 120. Wells *et. al*, 1990: 56. Kay, 1979: 344-347. Wilson and Gillett, 1979: 272.

Drillia (*Clavus*) H. and A. Adams, 1853: 91. Bouge and Dautzenberg, 1914: 139.

Pleurotoma (*Clavus*) Weinkauff, 1876: 54-56.

Austroclavus Cotton, 1947: 7-12.

Diagnosis

Shell small to medium, 6-30 mm, solid, high spired, truncated anterior end, often with thick shells. Protoconch paucispiral, 2 whorls, smooth, rounded. Teleoconch up to 8 whorls with axial sculpture including ribs or spines, spiral sculpture absent. Sinus wide, moderate depth, near suture. Callus strong. Outer lip thin, stromboid

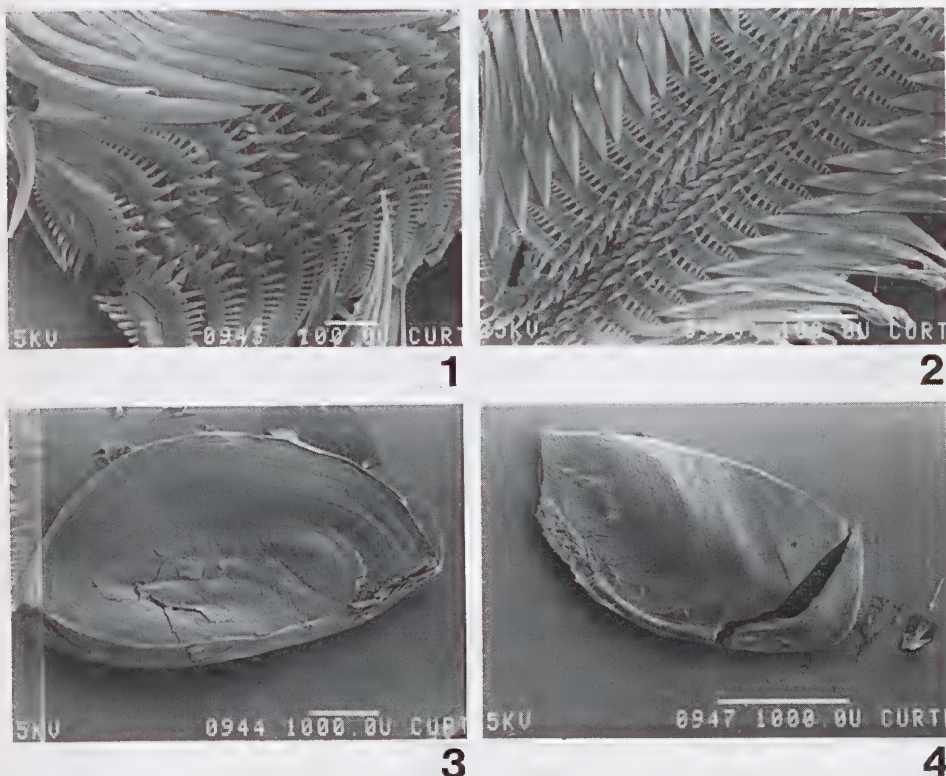


Plate 1. 1. *Clavus radulae* and operculae. 1. Radula of *Clavus exasperatus* AM C.156701. 2. Radula of *Clavus unizonalis* AM C.153109. 3. Operculum of *Clavus exasperatus* AM C.156701. 4. Operculum of *Clavus unizonalis* AM C.153109.

notch distinct. Anterior canal broad, short, weakly notched. Colour white to light brown or grey, often with brown bands. Operculum oblongate, nucleus terminal. Tropical Indo-Pacific and Atlantic Oceans. Intertidal to 150 m.

Remarks

Cotton (1947) placed several Recent species of Australian turrids in the genus *Austroclavus* Powell, 1942. Powell (1966) recognized no Recent species in the genus, and restricted *Austroclavus* to the Oligocene and Miocene of New Zealand and the Miocene of Victoria.

Clavus cf. *flammulatus* (Montfort, 1810)

Plate 2, Figures 1,2.

Clavus flammulatus Montfort, 1810: 435.

Shell

(based on W. A. specimens). Shell small, up to 14 mm, narrow, high spire, heavy. Up to 8 teleoconch whorls but upper shell broken off in all W. A. material. Suture distinct, slightly undulating. Upper surface of whorls smooth except for indistinct axial ribs. Ribs enlarge rapidly at about 1/3 down whorl, taper off but reach lower suture. Lower portion of ribs strong, broad, 15 on penultimate whorl. Ribs extend below lower shoulder of body whorl; final rib swollen into varix. Outer lip broken on all W. A. material. Sinus on upper shoulder at 30° angle to shell axis, deep, U shaped. Strong callus at entrance. Columella broad. Shell truncate, anterior canal short. Colour glossy white with occasional yellow blotches on the upper whorls and on the varix of the body whorl.

Type locality

Not known.

Location of types

Not known.

Material examined

AUSTRALIA: WA: 219-221 m, NW of Bunbury 33°S; 144°37'E (WAM); 165 m, 40 km W of Jurien Bay 30°21'S; 114°38'E (WAM); 146 m, Green Head 29°59'S; 114°25'E (2 WAM); 128-1312 m, SW of Dongara (29°49'S; 112°24'E (WAM); . OTHER AREAS: Makibojoc Bay, Bohol I., Philippines (WAM); 91 m, Walan I., Sulu Arch., Philippines (WAM); Tab I., Madang, PNG (WAM); 77-153 m, off Kg Talaga, Piru Bay, Ceram, Indonesia (WAM).

Other records

Cernohorsky (1978): Indo-Pacific. Springsteen and Leobrera (1986): Philippines.

Range

Indo-West Pacific; south on the Western Australian coast to Bunbury.

Remarks

Four specimens have been collected along the west coast of Western Australia; all were dead collected, with the tip of the spire and outer lip broken off. Their poor condition makes me reluctant to positively identify the shells as *C. flammulatus*, but the material matches specimens of the species in the WAM from the Philippines, Indonesia, and Papua New Guinea.

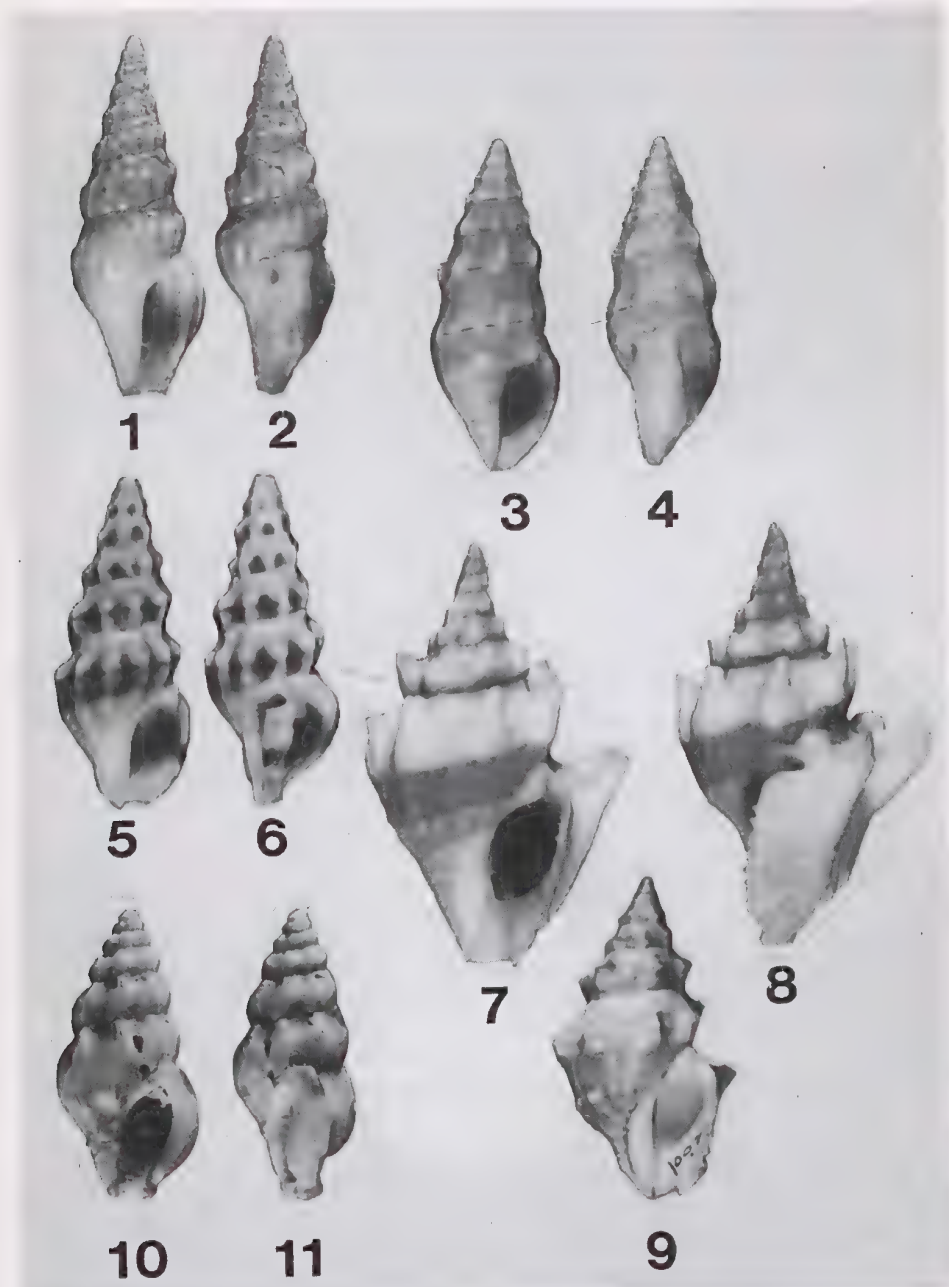


Plate 2. Shells of *Clavus*. 1,2. *Clavus* cf. *flammulatus* (Montfort, 1810). 3,4. *Pleurotoma bilineata* Reeve, 1845. Syntype, BM(NH) 1963475. 5,6. *Pleurotoma pulchella* Reeve, 1845. Syntype, BM(NH) 1984156. 7,8. *Clavus canalicularis* (Röding, 1798). AMS C.156592. 9. Syntype of *Pleurotoma auriculifera* Lamarck, 1816. MHNG 1097/48/1. 10, 11. *Clavus costatus* Hedley, 1922. Holotype, AMS C.8053.

Clavus bilineatus (Reeve, 1845)

Plate 2, Figures 3,4.

Pleurotoma bilineata Reeve, 1845: pl. 25, sp. 225.**Shell**

Shell of medium size, 17 mm, medium weight, high spire. Protoconch low but worn and indistinct, followed by up to 7 teleoconch whorls. Suture slightly undulating, indistinct. Upper surface of whorl flat, centre has 9-12 nodulose ribs which do not reach next suture. Ribs on adjacent whorls not aligned. Ribs on body whorl small, indistinct except for final one which is enlarged to form varix. Fine spiral growth lines present, but surface is smooth enough to appear glossy. Anterior end of shell with 6 spiral striae. Columella smooth, broad, glossy. Aperture elongated, sinus deep, constricted at entrance by pronounced callus. Outer lip thickened. Anterior canal of moderate width and depth, and slightly notched. Base colour light brown with pair of fine spiral orangeish lines. The lines are interrupted at the tops of the ribs. Area between lines white. Surface of ribs white. Body whorl with slightly darker brown band across middle.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Syntypes	17.3	6.7	6.2	0.39	0.36
	16.2	5.8	6.4	0.36	0.40
	13.3	5.4	4.9	0.41	0.37

Location of types

Syntypes, 3 specimens. BM(NH) 1963475.

Type locality

Capul and Mindoro Is., Philippines.

Material examined

Types. QLD: Second small reef area (12°34'S; 143°47'E) (AMS); 15-16 m depth, Jewell Reef (AMS); 6 m depth, No. 5 Ribbon Reef (AMS); 5 m, Hastings Reef, N of Cairns (AMS); Broadhurst Reef, E of Townsville (AMS); Lady Elliot I. (AIM).

OTHER AREAS: Madang area, PNG (4 WAM); 10 m, lagoon side, Enewetak Atoll, Marshall Is. (AIM); Philippines (AIM); Mauritius (2 AIM); Faaone, Tahiti (AIM); Tulagi I., Florida Group, Solomon Is. (AIM).

Range

6-16 m depth. Western Pacific; eastern Queensland as far south as Townsville.

Remarks

Tryon (1884) considered *C. bilineatus* to be a synonym of *C. pulchellus* (Reeve, 1845), an opinion with which Bouge and Dautzenberg (1914) concurred. However I have examined the types of both *C. bilineatus* and *C. pulchellus* (3 syntypes, BM(NH) 1984156) (Plate 2, Figures 5,6) and conclude that they are separate species. *C. pulchellus*, which has not yet been found in Australia, is larger than *C. bilineatus* but has 6 teleoconch whorls compared to 7 for *C. bilineatus*. The ribs of *C. pulchellus* are much stronger, giving the shell a much more angular appearance. The varix of *C. pulchellus* is formed by the penultimate rib on the body whorl instead of the ultimate rib as on *C. bilineatus*. The sinus of at least one syntype of *C. bilineatus* is strongly constricted at its entrance; this was not observed in the type

material of *C. pulchellus*. Colour patterns are very different: *C. pulchellus* has an off white background colour while *C. bilineatus* is light grey. *C. pulchellus* has a broad orange band on the lower part of the upper whorls and through the centre of the body whorl. *C. bilineatus* has a much thinner white band.

***Clavus canalicularis* (Röding, 1798)**

Plate 2, Figs. 7-9.

Strombus canalicularis Röding, 1798: sp. 1291.

Drillia auriculifera Lamarck, 1816: 91.

Pleurotoma auriculifera (Lamarck). Kiener, 1840: 51, pl. 11, fig. 2. Reeve, 1843: pl. 8, fig. 69.

Clavatula auriculifera Lamarck, 1816: 439, fig. 10. Blainville, 1827: t. 5, fig. 4.

Clavus canicularis (Röding). Powell, 1966: 77. Cernohorsky, 1972: 185, pl. 53, fig. 13.

Shell

Shell thick, of medium length, up to 30 mm long. Whorls 6-7, protoconch eroded on all specimens examined. Spire narrow, with a row of nodules on the upper whorls. Body whorl moderately larger. Nodules on last two whorls elongated into long, low axial ribs with pronounced spines which do not extend to margin of outer lip. 5 to 7 spines on each whorl, broad at base, tapering, up to 9 mm long, but some specimens have very short spines. In some specimens edge of the spine is recurved almost to form a tube. Suture adpressed, with deep, U shaped sinus on shoulder of body whorl. Spiral striae below spines may be nodulose. Columella smooth, slightly convex. Aperture moderately wide, outer lip squarish, may have fine serrations. Anterior siphonal canal broad, shallow, stromboid notch narrower, distinct, posterior canal small, narrow. Colour off-white, broad brown band across middle of body whorl may be present. Band does not extend to outer lip. Band darker on upper part of whorl. Aperture white or tinged with yellow, which may also occur on outer shell. Brown band extends onto upper whorls as a line above suture.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Low Isles, near Port Douglas, Qld. (AMS C.76027).					
	31.0	16.9	13.7	0.55	0.44
	31.6	18.2	13.6	0.58	0.43
	24.9	14.4	11.2	0.58	0.45
	26.0	16.1	11.5	0.62	0.44

Location of types

canalicularis: Unknown. *auriculifera*: Syntypes, 2 specimens. MHNG 1097/48/1 and 1097/48/2.

Type locality

canalicularis: Unknown. *auriculifera*: Philippines.

Material examined

AUSTRALIA: N.T.: Darwin (AMS); QLD: Lizard I., (AMS); 2-9m Lizard I. (AMS); Low Isles, NE of Port Douglas (AMS; WAM); Batt Reef, NE of Port

Douglas (AMS); Green I., N of Cairns; Langford Reef, Bowen (WAM); Broadhurst Reef, E of Townsville (3 AMS). OTHER AREAS: Japan (AMS); Gima, Ryukyu Is. (AIM); Enawetok Atoll, Marshall Is. (AMS); Philippines (AMS; 4 WAM; AIM); Samal I., Davao Bay, Mindinao (AIM); New Caledonia (AMS; WAM; AIM); Solomon Is. (AMS; AIM); 3 km N of Ataa Cove, N. Malaita, Solomon Is. (AMS). PNG: 1-12 m, Schouten Is. (AIM); Papaido Is. (AIM); New Britain (AMS); Nordup, east New Britain (AIM); 9-15 m Rabaul (AMS); Madang (WAM; AIM); Port Moresby (AMS); Hisiu, 70 km NW of Port Moresby (AM). Indonesia: 1 km W of Brak dock, Irian Jaya; 8 km NW of Rani, Schouten I., Irian Jaya; Ile. St. Marie, Noumea, New Caledonia (AMS); Mios Woendi Atoll (AIM).

Other records

Cernohorsky (1972): Indo-West Pacific (including Fiji), Hinton (1972): Papua New Guinea. Springsteen and Leobrera (1986): Philippines.

Distribution

0-24 m, in subtidal sand patches in reef. Western Pacific; Darwin, Northern Territory to Townsville, Queensland.

Remarks

Australian specimens examined all had a moderate body whorl and a width/length ratio of about 0.44 to 0.53. Some Western Pacific specimens are narrower, with shorter spines, making them similar to *C. exasperatus*. These specimens may still be distinguished as *C. canalicularis* by the spines on the last two whorls; while *C. exasperatus* has axial ribs, spines are never formed. In addition, *C. exasperatus* has a series of low, secondary ribs on the body whorl below the primary ribs. The syntypes of *Pleurotoma auriculifera* (Plate 2, Figure 9) also show the characteristic spines of *C. canalicularis*.

Several authors have spelled the species name as *canicularis*, but the spelling of Röding (1798) is *canalicularis*.

Abrard (1946-47) reported *C. cf. auricularia* from the Quaternary of the New Hebrides.

Clavus costatus Hedley, 1922

Plate 2, Figs. 10, 11.

Clavus costatus Hedley, 1922: 256, pl. 45, figs. 48, 49. (Not *Pleurotoma costatus* Reeve, 1845.

Austroclavus costatus (Hedley). Cotton, 1947: 12.

Shell

Shell small, 9 mm, solid, high spire. Protoconch of 2 smooth, rounded whorls, 0.31 mm high, 0.53 mm wide. 5 teleoconch whorls. Whorls convex with 8 rounded ribs/whorl which are continuous on succeeding whorls, those on body whorl have distinct nodules at their base followed by spiral striae. Suture fine, sinuous. Fine axial growth lines and spiral striae on outer shell surface. Columella smooth, callosity on upper margin. Aperture cylindrical, anterior siphonal canal broad, shallow, stromboid notch present but indistinct. Outer lip extends beyond last rib, fragile but slightly thickened. Colour off-white with pale brown band on lower half of body whorl and above sutures.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	6.1	2.8	2.3	0.46	0.38
Paratypes					
Mean (n=6)	7.3	3.1	2.8	0.43	0.39
S.D.	1.3	0.3	0.2	0.04	0.04
Range	6.1-	2.8-	2.5-	0.39-	0.31-
	9.4	3.7	3.0	0.48	0.44

Location of types

Holotype, AMS C.8053 (part). 5 paratypes, AMS C.8053 (part).

Type locality

40 m depth, off Darnley I., Torres Strait, Qld.

Material examined

Types.

Distribution

Known only from the type locality.

Remarks

Splendrillia candidulus (Hedley, 1922), discussed by Wells (1990), is similar in size to *C. costatus* and *C. undatus* (Hedley, 1907) (discussed below), but is readily separated by its higher spire, more numerous whorls, smaller body whorl, and less inflated aperture.

***Clavus aeneus* Hedley, 1922**

Plate 3, Figs. 1,2.

Clavus aeneus Hedley, 1922. Rec. Aust. Mus. 13: 255, pl. 45, fig. 46.

Austroclavus aeneus (Hedley). Cotton, 1947: 12.

Shell

Shell small, up to 14 mm long, heavy with a high spire. Protoconch smooth, lacks ribs, with 2 1/2 whorls, 0.27 mm high, 0.49 mm wide. 6 convex teleoconch whorls. Sutures slightly impressed. Eight strong low, axial ribs on each whorl join except on body whorl of adults. There is a series of 5 small spiral ribs near the base of the shell. Columella smooth, thickened with distinct callosity of upper end. Anterior siphonal canal of moderate length, posterior short. Outer lip heavily thickened with rib on margin. Color uniform off-white, glossy.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	10.9	3.9	3.7	0.36	0.34
Paratype	9.7	4.0	4.0	0.41	0.41
14°28'S; 145°00'E, north Queensland (AMS C.156699)					
	12.5	4.4	4.6	0.35	0.37
	12.0	4.6	4.8	0.38	0.40

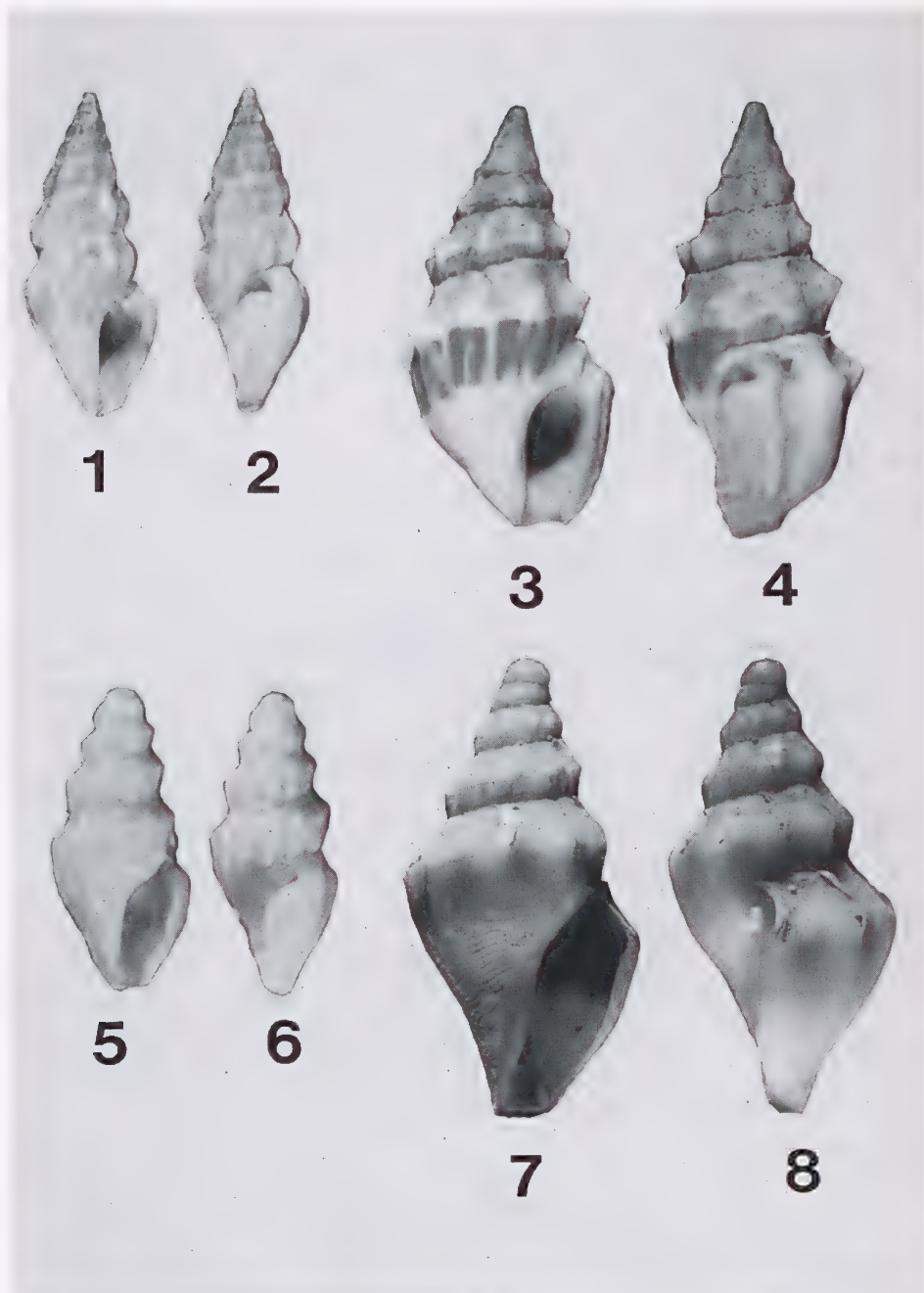


Plate 3. Shells of *Clavus*. 1,2. *Clavus aeneus* Hedley, 1922. Holotype, AMS C.103567. 3,4. *Pleurotoma exasperata* Reeve, 1843. Possible syntype, BM(NH) 1966462. 5,6. *Clavus hewittae* n. sp. Holotype, WAM 861-89. 7,8. *Inquisitor lacertosus* Hedley, 1922. Holotype, AMS C.37698.

Location of types

Holotype, AMS C.103567 and 1 paratype, AMS C.103568.

Type locality

9-15 m depth, Murray I., Torres Strait, Qld.

Material examined

Types. QLD: 55 m, Darnley I., Torres Strait (2 AMS); 27 m, 15°43.8'S; 145°29.2'E (AMS); 9-18 m, Hope I., SE of Cooktown (AMS); 20 m, Michaelmas Cay, off Cairns (AMS); 37 m, 15°45'S, 145°33'E N. Qld (AMS); 26 m, 14°28'S; 145°0'E (AMS); Horseshoe Bay, Magnetic I. (AMS); 27-43 m off Bowen (AMS). OTHER AREAS: PNG: 18-22 m, Manubada (Local) I., off Port Moresby (2 AMS).

Distribution

9-55 m depth in sandy mud from off Port Moresby, Papua New Guinea south on the eastern side of north Queensland as far as Townsville.

Remarks

C. aeneus is closest to *C. candidulus* (Hedley, 1922), discussed above, but is readily separated by its larger size, straighter axial ribs, and more rounded whorls.

***Clavus exasperatus* (Reeve, 1843)**

Plate 1, Figures 1,3. Plate 3, Figures 3,4.

Pleurotoma exasperata Reeve, 1843: pl. 2, fig. 8. Reeve, 1843: 32.

Pleurotoma (Clavus) exasperatus (Reeve). Weinkauff, 1876: 54, pl. 12, figs. 1,3. von Martens, 1880: 226.

Drillia (Clavus) exasperata (Reeve). H. and A. Adams, 1858: 91.

Drillia exasperata (Reeve). Tryon, 1884: 185, pl. 8, fig. 26. Smith, 1903: 603.

Drillia exigua var. *exasperata* (Reeve). Bouge and Dautzenberg, 1914: 136.

Pleurotoma exigua (Reeve). Hombron and Jacquinot, 1853: 111, pl. 25, figs. 21,22. (not *Pleurotoma exigua* C. B. Adams, 1852).

Drillia livida (Gmelin, 1791, non *Strombus lividus* Linnaeus, 1764); Hedley, 1909: 453, 454.

Clavus exasperatus (Reeve). Hedley, 1922: 257, pl. 45, fig. 50. Powell, 1966: 71.

Austroclavus exasperatus (Reeve). Cotton, 1947: 12.

Shell

Shell large for genus, 26 mm, heavy, high spired with spire reaching a sharp point. Protoconch of 2 small, rounded, smooth whorls. Teleoconch up to 10 whorls. Suture impressed. Upper whorls have row of 8-9 pointed nodules just below midpoint of whorl which give shell a turreted appearance; in some areas these may form short spines. Last nodule on body whorl extends down whorl as a varix, behind outer lip. Below nodules on body whorl is a row of low secondary ribs. Outer lip thin, serrated, stromboid notch prominent. Sinus deep, channeled with prominent callus. Columella straight, thin, slightly callused. Anterior siphonal canal short, broad. Aperture deep, subrectangular. Colour off-white, aperture glossy white. Queensland specimens may be completely off white or have a broad, light brown band across top of body whorl. In shells from New Caledonia the general colour is light brown, while those from Mauritius have a broader band interrupted by about 16 low, white ribs.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
<i>exasperatus</i> possible syntype	23.7	11.2	9.3	0.47	0.39
Off Townsville, Qld. (AMS C.156997, C.156998 and unnumbered)	26.3	11.2	9.7	0.43	0.37
	28.5	12.4	10.6	0.44	0.37
	25.7	12.3	9.3	0.48	0.36

Radula

Typically drilliline, with one central tooth on each side flanked by one marginal. Central tooth small, flat, leaf shaped, base 45 μm wide, broadening to 67 μm , before tapering to centre. Narrow ridge down entire surface of tooth extends into a point beyond flat part of tooth. Marginal teeth crescent shaped, 365 μm wide, tooth itself reaches maximum height of 55 μm . Series of up to 16 sharp spines on front of each tooth, increase in size until near centre of radula, maximum height 65 μm , final two or three spines smaller. Marginal teeth long, flat slightly curved blades, up to 630 μm long, 70 μm wide, with strong ridge along middle of outer part of tooth.

Operculum

(Plate 1, Figure 3). Brown, horny, flattened on columellar side, rounded on outer side, with fine growth lines over surface, nucleus nearly terminal. 6.3 mm long in a 28.6 mm shell.

Location of types

(*exasperata*): possible syntype, 1 specimen. BM(NH) 1966462. The types of *Pleurotoma exigua* should be in the MNHN, but are not and are apparently lost (Bouchet, pers. comm.).

Type locality

(*exasperata*) unknown. (*exigua*): Torres Strait, Qld.

Material examined

AUSTRALIA: WA: Ashmore Reef (WAM); QLD: 9-15 m Hope I., SE of Cooktown (AMS); Kelso Reef, NE of Townsville (AMS); Broadhurst Reef, E of Townsville (2 AMS); OTHER AREAS: Guam I., Marianas Is. (2 AIM); PNG: Inlet at N end Kranket I., Madang (AMS); off Tab I., Madang (WAM); Rabaul (AMS); New Caledonia (AMS); Lifu (AMS); Kira Kira, San Cristobal, Solomon Is. (2 WAM); 13 km SW Tg Ratoe, Maikoor, Aru, Indonesia (WAM); 5 m Enawetok Atoll, Marshall Is. (AMS); Japan (AMS); Port Blair, Andaman Is. (AIM); Mauritius (6 AMS; 3 AIM); Moroni, Grande Comore, Comores Arch., East Africa (AIM).

Other records

Springsteen and Leobrera (1986): Philippines (as *C. vidua*).

Distribution

Indo-West Pacific; south in eastern Queensland to Townsville.

Remarks

C. exasperatus is similar to *C. canalicularis* but is thinner, with a higher spire, and much shorter spines. The secondary ribs which are present on the body whorl

of *C. exasperatus* but not *C. canalicularis* are a key feature in separating the two species.

Clavus hewittae n. sp.

Plate 3, Figures 5,6.

Shell

Shell very small, 4 mm, light weight, high spire. Protoconch smooth, globose, 2 whorls, 0.36 mm high, 0.58 wide. 4 teleoconch whorls. Suture impressed, nearly straight. Whorls turreted at an angle declining to the left. About 12 strong, thin axial ribs per whorl. Start just below suture but are initially faint; subsutural area may appear to be a spiral cord. Ribs peak just above centre of whorl, tend to match on adjacent whorls. Final rib of body whorl swollen into a varix. Outer lip thickened. Sinus deep, U shaped. Callus absent. Columella thin, slightly callused. Shell truncate, anterior canal short, broad, shallow. Aperture rectangular. Colour glossy white in dead collected specimens.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	3.8	1.7	1.5	0.44	0.39
Paratypes (n=6)					
Mean	4.1	1.9	1.8	0.46	0.44
S.D.	0.3	0.2	0.1	0.01	0.02
Range	3.5-	1.7-	1.6-	0.45-	0.42-
	4.4	2.0	1.9	0.48	0.48

Holotype

139 m depth, Direction Bank, off Rottnest I. (31°44.4'S; 115°12.2'E) (WAM 861-89).

Paratypes

WA: 176-182 m depth, W of Garden I. (32°15.7'S; 115°06.7'E) (AMS C.161086; MV); 210-212 m depth, W of Garden I. (32°15'S; 115°07'E) (WAM 866-89); 146-160 m depth, west of Rottnest I. (32°00'S; 115°15'E) (AMS C.161117); 201-214 m depth, W of Rottnest I. (31°59.5'S; 115°13'E) (AMS C.161119); 182 m depth, W of Rottnest I. (31°59'S; 115°14'E) (AMS C.161118; QM; ZMA; NMNZ); 265-276 m depth, NW of Rottnest I. (31°45'S; 115°02'E) (AMS C.161087); 105 m depth, Direction Bank, off Rottnest I. (31°44.8'S; 115°15'E) (AMS C.161122); 139 m depth, Direction Bank, off Rottnest I. (31°44.4'S; 115°12.2'E) (WAM 864-89); 150 m depth, Direction Bank, off Rottnest I. (31°44.1'S; 115°10.6'E) (AMS C.161123); 183-192 m depth, NW of Rottnest I. (31°44'S; 115°03'E) (WAM 863-89); 150 m depth, off Rottnest I. 148 m depth, off Rottnest I. (31°41.3'S; 115°08.6'E) (AMS C.161120); (31°39.8'S; 115°07.1'E) (AMS C.161121); 146 m depth, W of Rottnest I. (31°00'S; 114°51'E) (AMS C.161111); 256 m depth, W of Rottnest I. (31°00'S; 114°51'E) (AMS C.161089).

Other material examined

WA: 81 m depth, Recherche Archipelago (34°09'S; 121°27'E) (WAM 865-89); 176-183 m depth, SW of Cape Naturaliste (33°35.1'S; 114°01.4'E) (WAM 867-89); 183-238 m depth, SW of Cape Naturaliste (33°44.5'S; 114°26.1'E) (AMS C.161084); 146-150 m depth, SE of Mandurah (32°41'S; 114°51'E) (AMS

C.161085); 154 m depth, WNW of Lancelin (30°58'S; 114°53'E) (AMS C.161088); 192-196 m depth, W of Cervantes (30°33.5'S; 114°40.5'E) (AMS C.161110); 154 m depth, W of Cervantes (30°33'S; 114°32'E) (WAM 868-89); 238-247 m depth, off Cervantes (30°32'S; 114°41'E) (AMS C.161112); 192-256 m depth, NW of Cervantes (30°30'S; 114°38'E) (AMS C.161115; SAM; MNHN); 128-140 m depth, NW of Green Head (30°37'S; 114°38'E) (AMS C.161116); 223-245 m depth, off Jurien Bay (30°08'S; 114°30'E) (WAM 862-89); 183 m depth, NW of Beagle I. (29°43.5'S; 114°20'E) (AMS C.161113); 274-283 m depth, NW of Beagle I. (29°43'S; 114°17'E) (AMS C.161114). All material was collected during cruises by HMAS 'Diamantina' and HMAS 'Moresby'.

Distribution

81-276 m depth, Recherche Archipelago to northwest of Beagle I., Western Australia.

Etymology

I am pleased to name this species after Mrs. Joy Hewitt in recognition of the many years of assistance she has generously given me and the mollusc department of the Western Australian Museum.

Remarks

At first inspection *Clavus hewittae* appears to be closest to *Guraleus flavescens* Angas, 1877 from off New South Wales. However *C. hewittae* has a lower spire, more prominent and more numerous ribs and a more flared outer lip.

Clavus lacertosus (Hedley, 1922)

Plate 3, Figures 7,8.

Inquisitor lacertosus Hedley, 1922: 242, pl. 44, fig. 32. Cotton, 1947: 7.

Micantapex lacertosus (Hedley). Laseron, 1954: pl. 1, fig. 14.

Shell

Shell large, 29 mm, high spire, light weight. Protoconch globose, smooth, 2.5 whorls, 0.75 mm high, 1.38 mm wide. Up to 6 teleoconch whorls. Suture impressed, nearly straight. Heavy axial ribs begin just below suture, enlarge rapidly to peak at centre of whorl, extend to lower suture, give whorl triangular appearance. Ribs do not match on adjacent whorls, 10 on penultimate whorl, 8 on body whorl, extend well past shoulder. Axial growth lines pronounced. Numerous fine spiral striae on all teleoconch whorls. Outer lip thickened, lacks stromboid notch. Sinus broad, shallow, callus absent. Columella broad, straight, indistinct. Aperture long, subrectangular. Shell truncate, anterior canal short, very broad, shallow, not notched. Colour yellowish orange with broad darker orange band between ribs, numerous incomplete short spiral lines on shell, aperture orange.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	13.6	6.8	6.7	0.50	0.49
Other specimens (117-137 m off Cape Moreton, Qld. [AIM])					
Mean (n=18)	20.4	9.4	9.3	0.46	0.46
S.D.	2.0	0.7	0.7	0.03	0.03
Range	16.5- 25.6	8.3- 11.0	8.3- 10.7	0.50- 0.50	0.51- 0.51

.Location of type

Holotype, AM C.37698.

Type locality

91 m, off Point Plomer, near Port Macquarie, New South Wales.

Material examined

QLD: 115-125 m depth, NNE Cape Moreton (2 AMS); 117-137 m depth, off Cape Moreton (AIM); 183-220 m depth, E of Cape Moreton (AIM); 73 m depth, off S end Fraser I. (AMS); 201 m depth, off S end Fraser I. (AMS); 210-219 m depth, off S end Fraser I. (AMS); 75-80 m depth, off Moreton Bay (AM); 115-176 m depth, E of Moreton Bay (2 AMS). NSW: 128-137 m depth, off Tweed Heads (AMS); 146 m depth, E of Tweed Heads (AMS); 152-155 m depth, E of Tweed Heads (AMS); 145 m depth, off Broken Bay (AMS).

Distribution

73-220 m depth, from Fraser I., Queensland to off Broken Bay, New South Wales.

Remarks

The proper generic placement of *lacertosus* has been uncertain. In his description of the species, Hedley (1922) originally placed it in the genus *Inquisitor*, a designation retained by Cotton (1947). Lasearon (1954) provisionally transferred *lacertosus* to *Micantapex* but compared it with *Pleurotoma bulbacea* Watson (1886) which Powell (1942) placed in *Aoteadrillia*. Lasearon suggested that *lacertosus* might be properly placed in *Aoteadrillia*.

***Clavus laetus* (Hinds, 1843)**

Plate 4, Figs. 1,2.

Clavatula laeta Hinds, 1843: 40. Hinds, 1845: 20, pl. 6, figs. 15, 16.

Drillia (Clavus) laeta (Hinds). H. and A. Adams, 1858: 91.

Pleurotoma (Clavus) laeta (Hinds) Weinkauff, 1876: 55-56, pl. 12, fig. 4,6.

Drillia laeta (Hinds). Tryon, 1884: 186, pl. 9, fig. 32, pl. 11, fig. 87.

Shell

Shell small, heavy, up to 15 mm long with high spire. Protoconch high, globose, two whorls, 0.44 mm high, 0.62 mm wide. Teleoconch of 7 whorls, each with up to 11 strong, low axial ribs which tend to line up from one whorl to the next. Suture distinct, slightly undulating. Area below suture flat, ribs begin above midpoint of whorl. Form sharp cusps pointing upwards, extend to lower suture. Penultimate rib of body whorl expanded into a varix, final rib low, outer lip extends beyond rib. Outer lip thickened. Shell surface smooth, glossy with faint axial lirae on surface. Ribs do not extend to tip of body whorl. Instead there are three strong spiral grooves. Aperture elongate, deep, subrectangular. Columella broad, slightly convex. Sinus deep, curved, deeply constricted at opening by callus. Anterior canal short, broad, deep, not notched. Stromboid notch shallow, but distinct. Colour glossy brown tinged with orange in some places; tips of ribs and rostrum white.

Material examined

Syntypes. AUSTRALIA: WA: Ashmore Reef (WAM); QLD: Osprey Reef, Coral Sea, 13°53'S; 146°31'E (AMS); Broadhurst Reef, E of Townsville (AM). OTHER AREAS: Hawaii (5 AIM); Tahiti (AIM); Christmas I. (Indian Ocean) (AMS; 3 WAM); Cocos (Keeling) Is., Indian Ocean (WAM).

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Syntypes	12.8	4.8	4.4	0.38	0.34
	10.1	3.3	3.8	0.33	0.38

Location of type

Syntypes, 2 specimens. BM(NH) 1879.2.26.67.

Type locality

13-18 m depth, Straits of Macassar, New Guinea.

Other records

Maes (1967): Cocos (Keeling); Cernohorsky (1978): Indo-West Pacific. Kay (1979): Hawaii. Springsteen and Leobrera (1986): Philippines. Wells *et al.* (1990): Christmas I. (Indian Ocean).

Distribution

Indo-West Pacific; Ashmore Reef, Western Australia to Broadhurst Reef, east of Townsville, Queensland.

Remarks

C. laetus has not previously been recorded from Australia. It is common under dead coral slabs in shallow water. The high spire, brown colour with white tips to the ribs, and white rostrum easily separate *C. laetus* from other Australian drilliines.

***Clavus lamberti* (Montrouzier, 1860)**

Plate 4, Figs. 3,4.

Pleurotoma lamberti Montrouzier, 1860: 117, pl. 2, fig. 10. Tryon, 1884: 198, pl. 13, fig. 76.

Pleurotoma (*Drillia*) *lamberti* (Montrouzier). Kobelt, 1887: 222-223, pl. 41, fig. 10.

Drillia (*Clavus*) *lamberti* (Montrouzier). Bouge and Dautzenberg, 1914: 139.

Shell

Shell small, 9 mm, high spired, light weight. Protoconch high, smooth, globose, 2 whorls. Up to 7 teleoconch whorls. Suture a thin but distinct, undulating line. Upper surface of each whorl smooth, followed by strong broad axial ribs which extend to lower suture; 9 on penultimate whorl, 8 on body whorl. Final rib on body whorl enlarged into a varix; last third of whorl smooth. Ribs on body whorl do not reach end of shell, replaced by four spiral striae. Outer lip thickened, curved inwards, with distinct stromboid notch. Sinus deep, strongly constricted at entrance by heavy callus. Columella broad, callused, convex. Anterior canal truncate, broad. Shells colourful: light brown on upper part of each whorl followed by thin bright brown axial line. Ribs a white band on upper whorls with a second brown line just above suture; lower whorls have a third line. Body whorl has six thin, brown lines across it. Areas between lines are various shades of white and light brown. There is a patch of darker brown on the varix. Lower part of body whorl white with brown splotches. Aperture white.

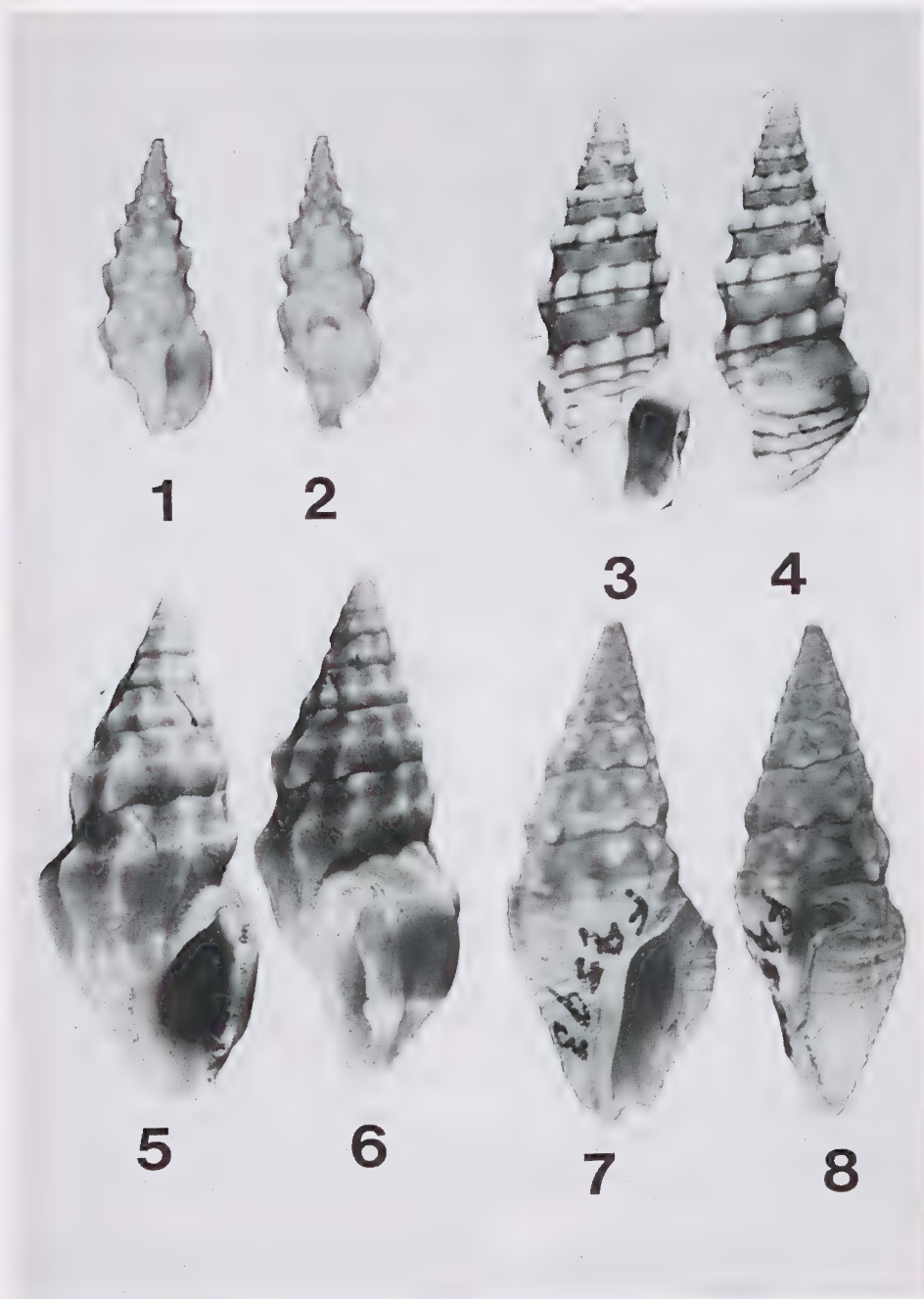


Plate 4. Shells of *Clavus*. 1,2. *Clavatula laeta* Hinds, 1843. Syntype, BM(NH) 1879.2.26.67. 3,4. *Clavus lamberti* (Montrouzier, 1860). Holotype, MNHN. 5,6. *Clavus obliquatus* (Reeve, 1845). AMS C.34388. 7,8. *Clavus occiduus* n. sp. Holotype, MV F4593.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Possible holotype	9.7	4.6	3.5	0.47	0.36
Mean (n=6)	8.5	3.2	3.5	0.38	0.38
S. D.	0.6	0.2	0.1	0.03	0.03
Range	7.8-	3.0-	3.3-	0.34-	0.38-
	9.4	3.4	3.6	0.43	0.45

Location of type

MNHN, possible holotype.

Type locality

Isle Art, New Caledonia.

Material examined

Possible holotype. AUSTRALIA: WA: Ashmore Reef (WAM); QLD: W end Raine I. (11°36'S; 144°01'E) (AMS); Great Detached Reef 11°44'S; 144°03'E (AMS); 4.5-14.5 m, First Three Mile Opening 13°28'S; 144°02.5'E. (AMS); Saumarez reef, 21°52'S; 153°27'E (AMS); OTHER AREAS: Cocos (Keeling) Is. (Indian Ocean) (WAM). Lifu, New Caledonia (AIM); Upolu, W. Samoa (AIM); Ryukyu Is. (4 AIM); Mauritius (4 AIM).

Other records

Habe (1964): Indo-West Pacific; Maes (1967): Cocos-Keeling; Cernohorsky (1978): Indo-West Pacific. Springsteen and Leobrera (1986): Philippines.

Distribution

Indo-West Pacific; Ashmore Reef, Western Australia to northern Queensland.

Remarks

C. lamberti is here recorded for the first time from Australia. The specimens from Queensland are all juveniles but have the distinctive colour pattern of *C. lamberti*.

***Clavus obliquatus* (Reeve, 1845)**

Plate 4, Figures 5,6.

Pleurotoma obliquata Reeve, 1845: pl. 29, sp. 262. Reeve, 1845: 115. Smith, 1879: 191.

Pleurotoma (Drillia) obliquata (Reeve). Kobelt, 1887: 202, pl. 39, fig. 4.

Drillia obliquata (Reeve). Smith, 1879: 191. Tryon, 1884: 203, pl. 11, fig. 1. Melvill, 1917: 155.

Clavus obliquatus (Reeve). Kuroda and Habe, 1952: 47.

Shell

Shell small, 21 mm, heavy, with high spire. Six whorls, protoconch broken off. 10-13 wavy ribs/whorl, slightly offset on succeeding whorls. Last rib of body whorl greatly expanded into a varix. Lip extends beyond varix, but broken in specimens examined. Sutures wavy. Callus present, columella smooth, straight, thickened. Anterior siphonal canal of moderate length. Aperture cylindrical. Shell brown with three spiral white lines on body whorl, one on upper whorls, aperture white.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Andamans (AMS C.34338)	21.2	9.0	7.2	0.42	0.34
Low Isles, Qld. near Port Douglas (AMS unnumbered)	16.8	7.5	6.6	0.45	0.39
Noumea, New Caledonia (AMS C.30504)	17.9	7.5	6.8	0.42	0.38

Material examined

AUSTRALIA: QLD: Low Isles, near Port Douglas (AMS). OTHER AREAS: New Caledonia (AMS); Andaman Is.

Location of type

Most of Reeve's types are in the BM(NH) but the type material of *C. obliquatus* is not.

Type locality

None listed by Reeve (1845).

Distribution

16-22 m depth. Western Pacific. Known in Australia only from Low Isles, near Port Douglas, Queensland.

Remarks

Compared to *C. laetus* and *C. lamberti*, *C. obliquatus* has a much heavier but drab shell, a lower spire, and more solid ribs.

***Clavus occiduus* n. sp.**

Plate 4, Figures 7,8.

Shell

Shell heavy, medium length, 19 mm, high spire. Protoconch broken off. 9 teleoconch whorls. Suture distinct, slightly irregular. Whorls convex with strong, broad axial ribs which tend to join on adjacent whorls, extend suture to suture and well down body whorl, 10 on body whorl, 9 on penultimate whorl. Ribs low just below upper suture, decrease, then become largest at middle of whorl. Crossed by numerous fine spiral lirae which become thickest across middle of whorl and form spiral cords. About 20 cords on body whorl extend to anterior tip of shell. Outer lip thickened into varix, incurved. Sinus on shoulder, deep U shaped, slightly constricted at entrance by strong callus. Columella of moderate width, margin pronounced. Aperture deep, glossy white. Anterior canal short, broad, deep, anterior of shell truncate. Shell a uniform chalky white with small light brownish patches on the upper parts of the first six axial ribs on the body whorl.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	19.1	7.8	5.2	0.41	0.27

Location of type

Holotype, MV F4593.

Type locality

Central bank, Roebuck Bay, Broome, Western Australia.

Distribution

Known only from the type locality.

Remarks

This species was recognized as new by Dr. A. W. B. Powell and a draft description was written his manuscript "Turridae, Subfamily Clavinae of the Indo-Pacific" which he intended for publication as part of his series in Indo-Pacific Mollusca. Unfortunately the paper was never published. According to Powell's manuscript, *Clavus occiduus* resembles the Indian *Pleurotoma aglaia* Dall, 1918 and *P. crassa* Smith, 1888 which Powell considered to be synonymous. He considered *C. occiduus* to be smaller, with a shorter spire, distinct subsutural marginal cord, narrower and deeper shoulder sulcus, and crisper sculpture.

Etymology

I have followed Powell's intentions in naming the species. His unpublished manuscript did not state a reason for his choice of the specific name.

***Clavus aenigmaticus* n. sp.**

Plate 5, Figures 1,2.

Shell

Shell small, narrow, high spire, biconic. Protoconch of three whorls, smooth, conical, surface eroded, 0.82 mm wide, 0.75 mm high. 8 teleoconch whorls. Suture thin, distinct. Whorls convex with thin but distinct axial ribs which extend from suture to suture and well down body whorl, 17 on body whorl, 14 on penultimate whorl. Ribs largest at middle of whorl. 8 fine spiral ribs at anterior of shell the only spiral sculpture. Very faint axial growth lines. Shell juvenile, outer lip thin, broken, structure of sinus and presence or absence of callus cannot be determined. Columella narrow, slightly convex, with one of the axial ribs crossing surface. Aperture deep, elongate oval. Anterior canal short, broad, shallow, margin chipped. Colour glossy off-white with several strong, irregular, light brown blotches. Lower half of body whorl very faint light brown, narrow white band across centre of shell, light brown on upper body whorl; pattern repeated on upper whorls but fades out on upper part of spire.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	18.6	7.4	7.1	0.40	0.38

Location of type

Holotype, MV 58423.

Type locality

Central bank, Roebuck Bay, Broome, Western Australia.

Distribution

Known only from the type locality.

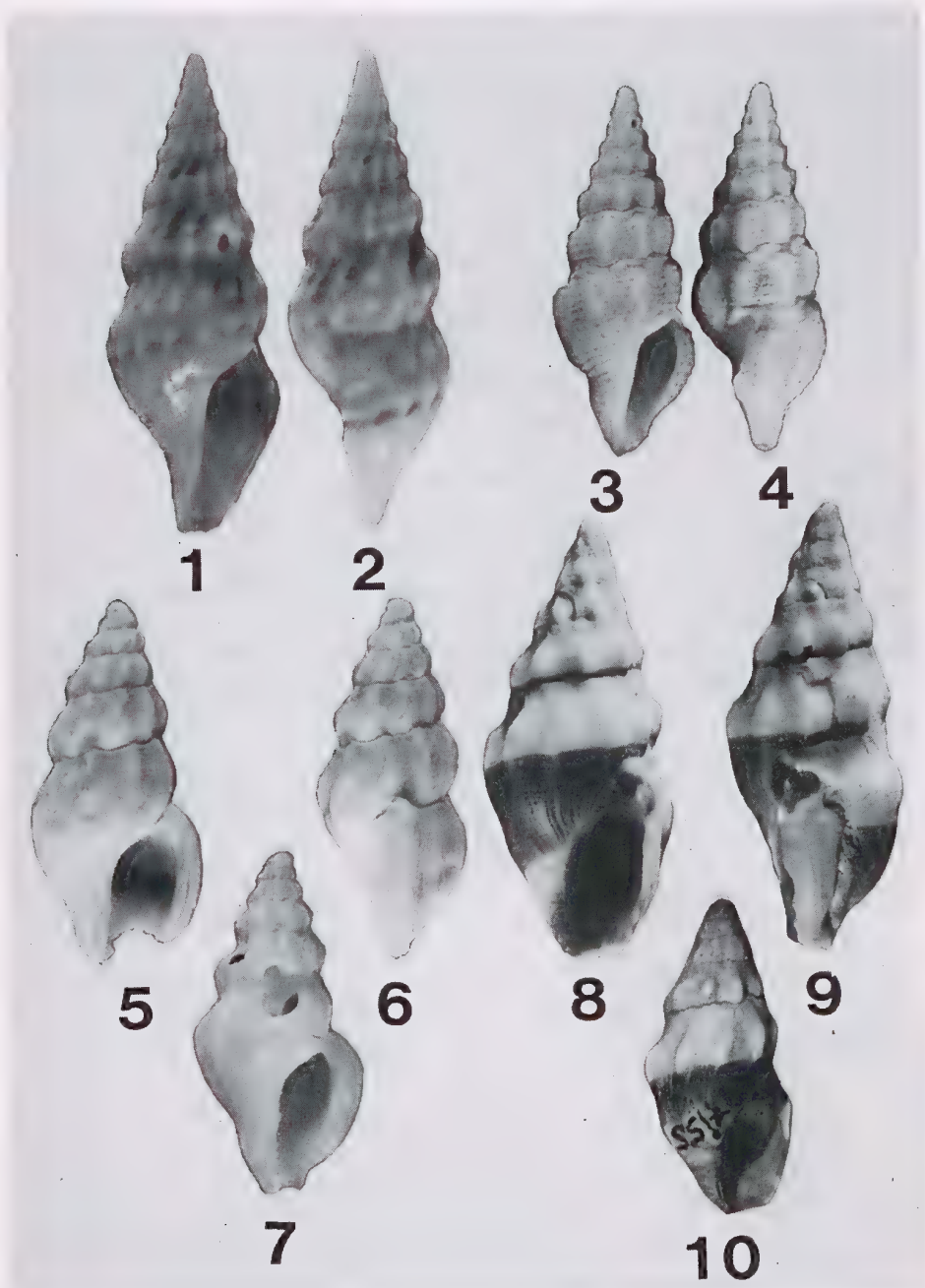


Plate 5. Shells of *Clavus*. 1,2. *Clavus aenigmaticus* n. sp. Holotype, MV F58423. 3,4. *Clavus pulicarius* n. sp. Holotype, WAM 480-91. 5,6. *Aspella undatus* Hedley, 1907. AM C.25774. 7. *Clavus undatus*. Off Cervantes, W. A. WAM. 553-91. 8,9. *Clavus unizonalis* (Lamarck, 1822). 10. *Pleurotoma unizonalis* Lamarck, 1822. Holotype MHNG 1097/55.

Remarks

Powell (unpublished) originally included the holotype of *Clavus aenigmaticus* as a paratype of *C. occiduus*. While the two specimens were in the same lot, they are clearly separate species. Powell himself would probably have realized this had he been able to complete the manuscript on the Clavinae. *C. aenigmaticus* can be readily separated from *C. occiduus* by having a narrower shell, the absence of spiral sculpture, narrower, more numerous axial ribs, and the colour pattern. The outer lip of *C. aenigmaticus* is thinner and does not form a varix, but this may possibly be due to the shell being juvenile.

Etymology

The specific name refers to the enigma the species originally presented to me in that it was included with the holotype of *C. occiduus* in Powell's draft manuscript.

Clavus pulicarius n. sp.

Plate 5, Figures 3,4.

Shell

Shell of medium size, 14 mm, claviform, turreted, solid, very high spire. Protoconch low, rounded, 2 whorls, smooth, 0.46 mm high, 0.54 mm wide. 8 teleoconch whorls. Suture distinct, slightly undulating. Sculpture complex, dominant feature is up to 8 strong, broad axial ribs per whorl, begin just below upper suture, extend to lower suture, greatest at midwhorl. Ribs extend most of the distance down the body whorl, do not form varix. Distinct marginal spiral cord just below suture on each whorl; 4 spiral cords cross ribs on upper whorls. About 16 spiral cords on body whorl, sometimes with a single low ridge between cords. Outer lip slightly thickened but broken in holotype. Subsutural sinus present but depth cannot be determined due to chipping on lip. Slight callus. Columella smooth, narrow. Aperture elongate, narrow. Shell truncate, anterior canal short, moderate width, shallow. General shell colour uniform glossy off-white, protoconch and aperture similar, with numerous yellowish flecks over shell surface, primarily on spiral cords.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	14.0	5.3	4.7	0.38	0.34
Paratypes WAM 481-91	15.7	5.4	5.3	0.34	0.34
WAM 482-91	17.3	5.9	6.1	0.34	0.35
	14.8	5.4	5.3	0.36	0.36
	15.0	6.0	5.7	0.40	0.38

Location of types

Holotype, WAM 480-91. Paratypes, WAM 481-91 (2 specimens), WAM 482-91 (3 specimens).

Type locality

40 m depth, 5 km NNE of Anchor I. off Onslow, Western Australia.

Paratypes

WA: 40 m, 5 km NNE of Anchor I., off Onslow (WAM 481-91). 51 m, 11 km N of Long I., off Onslow (WAM 482-91);

Distribution

Known only from off Onslow, Western Australia.

Remarks

The late Dr. A. W. B. Powell determined that this species was new and wrote a description of it in "Turridae, Subfamily Clavinae of the Indo-Pacific" which he intended for publication in Indo-Pacific Mollusca. Unfortunately the paper was never published and the species never described.

Clavus pulicarius is closest to *C. occiduus* described above, but may be distinguished by having a taller spire, more (16 vs. 10) and stronger axial ribs, more distinct spiral cords, and an overall pattern of yellowish flecks.

Etymology

Powell's draft manuscript used the name *Clavus pulicarius* for the species, without indicating the reason for the choice of name. In accordance with Powell's intentions I have retained the name *C. pulicarius*.

Clavus undatus (Hedley, 1907)

Plate 5, Figures 5-7.

Aspella undata Hedley, 1907: 294, pl. 55, fig. 15. Hedley, 1922: 257.

Austroclavus undatus (Hedley). Cotton, 1947: 12.

Shell

Shell small, thin, high spired. Protoconch of 2 whorls, smooth, glossy, 0.62 mm high, 0.80 mm wide. Remainder of shell 5 whorls, each with 8-9 low, gently curving varix-like ribs which line up on adjacent whorls. Distinct growth lines present. Aperture ovate, lip thickened by varix. Anterior canal short, broad. Sutures moderately indented. Colour off-white with faint brown band across whorl which can be seen through aperture.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	6.5	3.0	2.2	0.46	0.34
183 m off Woolongong, NSW (AMS C.18157)	6.5	2.9	2.5	0.45	0.38
Off Cervantes, W. A.	6.4	3.0	3.0	0.47	0.47

Location of types

Holotype, AMS C.25774 and 4 paratypes, AMS C.25774.

Type locality

146 m depth, 35 km east of Narrabeen, Sydney, NSW.

Material examined

Types. NSW: 183 m off Wollongong (AMS). WA: 192-256 m NW of Cervantes (30°30'S; 114°38'E)(WAM).

Distribution

Previously known only from 146-183 m off New South Wales, but now also known from Western Australia.

Remarks

A handwritten remark in a proof sheet of Hedley (1922), apparently written by Hedley, states "*Clavus undatus* is probably not a turrid. 10/1/23". Because of this Laseron (1954) rejected *C. undatus* from the New South Wales list, but it is in fact a turrid.

C. costatus is of about the same size and close in shell characters to *C. undatus*, but although he described both, Hedley (1922) did not compare the two. The two species come from very different localities, with *C. costatus* described from the tropical waters off Darnley I. and *C. undatus* from temperate waters off Sydney. In addition to being geographically separated, close examination shows several characters by which the two species can be separated. *C. undatus* has a much larger, domed protoconch and thinner, wavy axial ribs which do not match on adjacent whorls. *C. costatus* has very fine spiral striae which are absent on *C. undatus*.

The W. A. specimen (Plate 5, Fig. 7) is identical to the type material, but comes from a very different geographical area.

Clavus unizonalis (Lamarck, 1822)

Plate 1, Figures 2,4; Plate 5, Figures 8-10; Plate 6, Figures 1, 2.

Pleurotoma unizonalis Lamarck, 1822: 92. Kiener, 1839: pl. 22, fig. 2. Reeve, 1843: pl. 13, sp. 113. Weinkauff, 1876: 62, pl. 13, figs. 5,6.

Pleurotoma vidua Reeve, 1845: pl. 22, sp. 192. Weinkauff, 1876: 60, pl. 13, figs. 1,3.

Drillia (Clavus) unizonalis (Lamarck). H. and A. Adams, 1858: 91.

Drillia unizonalis (Lamarck). Tryon, 1884: 185-186, pl. 9, figs. 30, 33, 34, 38; pl. 32, fig. 48.

Clavus unizonalis (Lamarck). Powell, 1966: 71. Short and Potter, 1987: 108, pl. 53, fig. 13.

Clavus vidua (Reeve). Wilson and Gillett, 1979: 272, pl. 66, fig. 10. Wells and Bryce, 1986: 120, pl. 40, fig. 466.

Tylotia unizonalis (Lamarck). Habe and Kosuge, 1970: 95, pl. 38, fig. 3.

Shell

Shell medium length, 26 mm, heavy, high spire. Protoconch smooth, rounded, 2 whorls, 0.58 mm high, 0.89 mm wide. Up to 9 teleoconch whorls. Spire moderately high, narrow, body whorl not inflated. Suture adpressed, sinuous. Each whorl has about 8 to 10 strong, broad, low axial ribs which make the outer whorl triangular or convex in shape. The ribs begin about 1/3 down the whorl, reach a maximum by midwhorl, then decrease but reach the lower suture, not continuous on adjacent whorls. Ribs extend well down body whorl to just above the anterior tip of shell. There is a series of about 8 spiral cords on the anterior tip. Outer lip thickened. Sinus on shoulder, deep, U shaped, entrance might be slightly constricted by very strong callus. Columella smooth, slightly convex, narrow, margin distinct. Aperture subrectangular. Shell truncate, anterior canal short, broad, shallow, tip slightly notched. Colour variable, usually light gray with a broad dark brown band of varying width below ribs on body whorl. In some specimens the band continues as a thin brown line above the suture. Brown exterior band shows through inner aperture.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
<i>unizonalis</i>					
Holotype	21.9	10.5	9.2	0.47	0.42
<i>vidua</i>					
Syntypes	22.1	10.1	9.6	0.46	0.43
	20.9	9.7	8.5	0.46	0.41
	19.7	7.5	8.5	0.38	0.43
Low Isles, off Port Douglas, Qld. (AMS C.89643)					
Mean (n=12)	20.1	8.2	7.8	0.41	0.39
S. D.	2.4	0.9	0.7	0.03	0.02
Range	17.3- 25.9	7.2- 9.8	7.4- 9.2	0.37- 0.45	0.36- 0.44

Radula

Plate 1, Figure 2. Radula typically drilliine with one central tooth flanked on each side by a single lateral and single marginal. Central tooth a flat plate, 23 μm wide across base, 26 μm high. Sides taper inwards slightly for first 22 μm , then move sharply to centre. Strong ridge down centre of tooth extends into a sharp point beyond end of flat portion. Lateral teeth curved, up to 200 μm broad on photograph, but outer portions concealed by marginal teeth, 50 μm broad. Up to 10 sharp spines on front of tooth, but additional spines covered by marginal teeth. Spines increase towards centre of radula, reaching maximum of 50 μm , last three reduced. Marginal teeth long, slightly curved, up to 460 μm long, 50 μm wide, with strong ridge down centre of outer part of tooth. Base of tooth club shaped.

Operculum

Plate 1, Figure 4. Horny, thin, light brown, nearly straight on columellar side, rounded on outer margin, numerous growth striae, nucleus terminal. 5.4 mm long in a 25.6 mm shell.

Location of types

unizonalis: Holotype, MHNG 1097/55. *vidua*: Syntypes, 3 specimens. BM(NH) 1966435.

Type locality

unizonalis: Unknown. *vidua*: Masbate I., Philippines.

Material examined

Types. AUSTRALIA: QLD: Torres Strait (AMS): Thursday I., (2 AMS); Yam I. (AMS); 9-15 m Murray I. (AMS); Raine I. (AMS); Somerset, Cape York Peninsula (2 AMS); Lizard I. (10 AMS; 2 WAM); Two Isles, Cape Flattery (AMS); Three Isles, Cape Flattery (AMS); Low Isles, NE Port Douglas (8 AMS; AIM); Green I., N of Cairns (AMS); Hope I., S of Cooktown (3 AMS); Michaelmas Cay, NE of Cairns (AMS); Little Upolu Cay (Middle Cay), NE of Cairns (2 AMS); Cairns (AIM); Green I., off Cairns (AIM); Mission Beach, between Tully and Innisfail (AIM). OTHER AREAS: PNG: Port Moresby (AMS); Gaire Beach, 48 km E Port Moresby (AMS); E side Belair I., Madang (AMS); Mongop, via Kaveng, New Ireland (2 AMS); Milne Bay (AMS); Kuia I., Luscony Is, Trobriand Group (2 AMS); Siassi I., W of New Britain (2 AMS); New Britain (2 AMS); Tavui, Rabaul, New Britain (2 AMS; MV); Rabaul Harbour,

New Britain (AMS); Ceram, Indonesia (3 WAM); Bali, Indonesia (AIM); New Caledonia (AMS); Lifu (8 AMS; 2 MV; 4 AIM); Poindimere (AMS; 2 AIM); Solomon Is: Makeira Harbour, Cristoval (2 AMS); Laulasi I., S of Aoki, Malaita I. (AMS); Ata'a I. (AMS); reef, entrance to Aoki Harbour, W coast Malaita I. (AMS); Kumbaro (AMS). Fiji (AMS; 4 AIM): Nadi Bay (2 AMS); Komave, coral coast, Viti Levu (AMS); Komave, S coast Viti Levu (AMS); Souvi Bay (AMS); Lakeba I., Lau Is. (AIM); Nananu-I-Ra I., N of Viti Levu (2 AIM); Port Vila, Efate, New Hebrides (AMS); Panape I., E Caroline Is. (AMS). Philippines: (2 WAM); Matabungkan, Luzon Province (AMS); S. Cebu (AMS); Oshima, Japan (AMS); Ryukyu Is. (AIM); Guam I., Marianas Is. (2 AIM); W. Samoa (4 AIM); NW Corner, Mbudga I., 16 km N of Dar es Salaam, Tanzania (AMS).

Other records

Cernohorsky (1972): Indo-West Pacific. Kilburn (1988): southern Africa.

Distribution

Intertidal to 15 m, and in sand under dead coral in shallow water. Indo-West Pacific; Dampier Archipelago, Western Australia to Lizard I., Queensland.

Remarks

As the list of synonymies above indicates, the description of the two species, *Pleurotoma unizonalis* Lamarck, 1822 and *P. vidua* Reeve, 1845 has caused considerable confusion. Reeve (1843; 1845) figured both *P. unizonalis* and *P. vidua*, listing the habitat of both as Masbate I., Philippines but showing two clearly different forms with *C. unizonalis* being stouter with a lower spire. However, as long ago as 1898, Melvill and Sykes remarked that the two species appear to be very closely related, if not identical. An examination of the type material shows that the only difference between the two forms is in colouration, but among non-type material there is a full range from specimens with the solid dark brown on the lower half of the body whorl represented by *C. viduus* to the clearly restricted brown line across the body whorl of *C. unizonalis*. This variation can be seen even within a single population. Also, some specimens within a population can have a higher spire and a lower width/length ratio than other individuals. The conclusion then is that there is a single variable species, and the name *Pleurotoma unizonalis* Lamarck, 1822 has priority.

Kilburn (1988) described the radula and provided notes on the anterior body of *C. unizonalis*. Abrard (1946-47) recorded *C. unizonalis* from the Pliocene of the New Hebrides.

Genus *Plagiostropha* Melvill, 1927

Plagiostropha Melvill, 1927: 151. Type: by monotypy,

Plagiostropha quintuplex Melvill, 1927.

Clavus (*Plagiostropha*) Melvill. Powell, 1966: 71. Shuto, 1983: 293-295.

Shell

Shell small, heavy, high spire, biconic. Protoconch small, 2 whorls, smooth, globose. Up to 9 teleoconch whorls. Strong pentagonal ribbing on most species. Shell truncated, sinus very deep, margins elevated, on upper shoulder at 30° degree angle to shell axis. Outer lip strongly incurved, aperture narrow. Body whorl with pronounced low varix.

Remarks

Melville (1927) proposed *Plagiostrophia* as a separate genus, but Powell (1966) and Shuto (1983) regarded it as a subgenus of *Clavus*. Springsteen and Leobrera (1986) included one of the species of *Plagiostrophia*, *P. opalus* in *Clavus* (*Clavus*). There are now five species in the genus, and all are clearly separable at the generic level from *Clavus flammulatus* Montfort, 1810, the type species of *Clavus*. The distinctive features of *Plagiostrophia* are the biconic shape, strong varix on the left side of the body whorl, lack of strong axial ribbing on the body whorl, very deep sinus, reflected lip, narrow aperture and truncated body whorl. Four of the five species have characteristic pentagonal ribbing.

***Plagiostrophia flexus* (Shuto, 1983)**

Plate 6, Figures 3,4.

Clavus (*Plagiostrophia*) *flexus* Shuto, 1983: 293-296, figs. 1,2.

Shell

Shell small, 9 mm, heavy, medium spire with axis of coiling slightly offset. Protoconch globose, large, 2 whorls, 0.53 mm high, 0.53 mm wide. Teloconch 7 whorls, pentagonal with 5 flattened ribs/whorl, continuous on succeeding whorls. Ribs highest just below midpoint of whorl, become shallower then have secondary peaks. Sutures wavy, highest on ribs. Numerous fine growth lines. Body whorl slightly flattened, last half lacks ribs. Columella straight, sinus deep with callus, broadens at end. Aperture thin, cylindrical. Anterior siphonal canal broad but deep, outer lip thickened. Shell glossy off-white colour, aperture white.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	9.0	4.1	3.5	0.46	0.39

Location of type

Holotype, AMS C.134665.

Type locality

124 m depth, 160 km north of Croker I., Northern Territory (9°30'S; 132° 34'E).

Material examined

Holotype.

Distribution

Known only from the type locality.

Remarks

Three syntypes of *Plagiostrophia opalus* (Reeve, 1845) were examined in the BM(NH), registration number 19631069. The two species are very close, but differ in that *P. opalus* is slimmer, the body whorl is not as angular, and *P. opalus* has up to 35 fine spiral striae on the whorls which are absent on *P. flexus*. These do not reach the anterior end of the body whorl of *P. opalus*. The two are treated here as separate species.

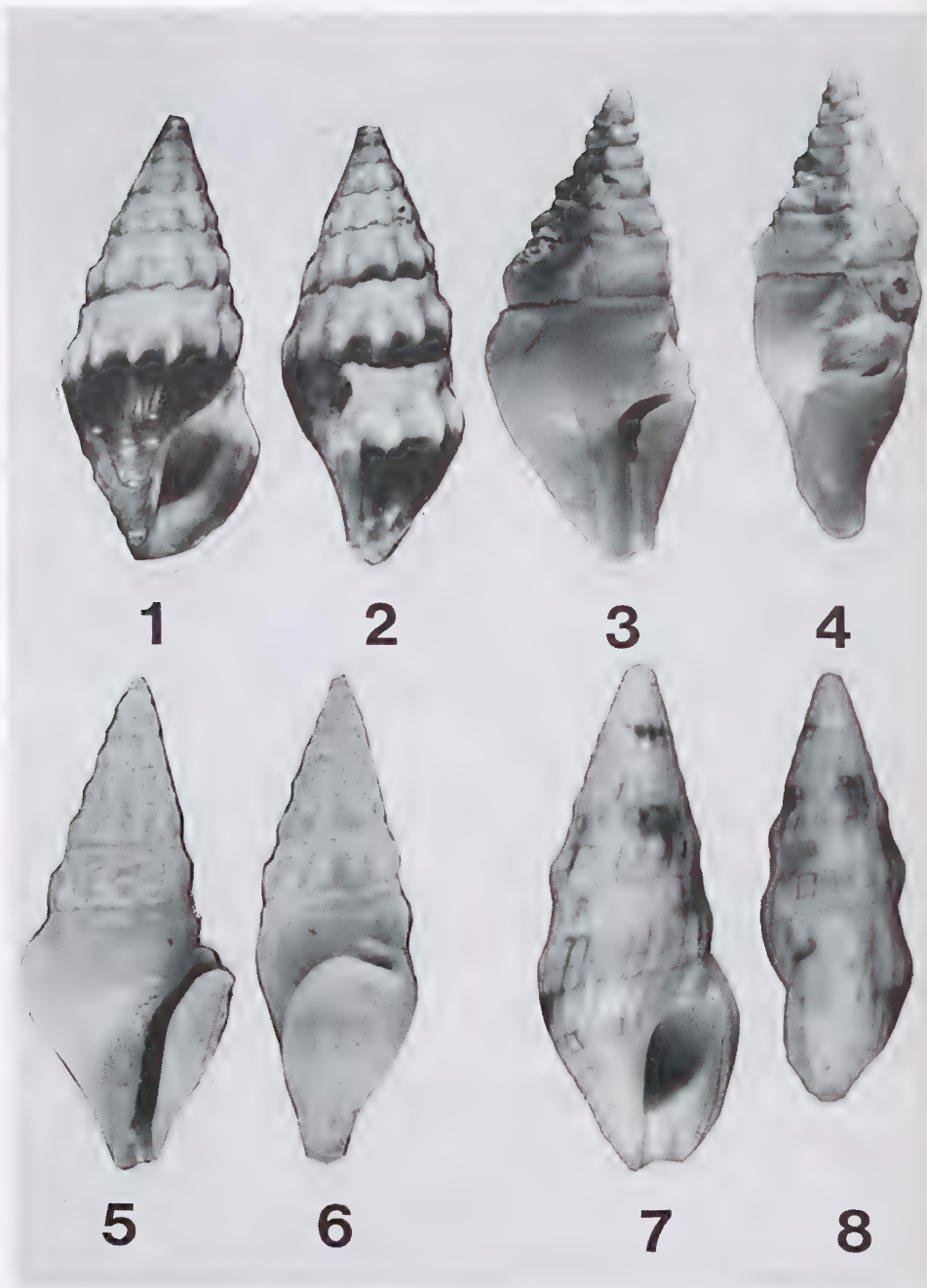


Plate 6. Shells of *Clavus*, *Plagiostropha* and *Tylotiella*. 1,2. *Pleurotoma vidua* Reeve, 1845. Syntype, BM(NH) 1966435. 3,4. *Clavus flexus* Shuto, 1983. Holotype, AMS C.134665. 5,6. *Plagiostropha sinecosta* n. sp. Holotype, WAM 211-90. 7,8. *Pleurotoma pica* Reeve, 1843. Syntype, BM(NH) 1963875.

Plagiostropha sinecosta n. sp.

Plate 6, Figures 5,6.

Shell

Shell small, 17 mm, high spired, biconic. Protoconch of two smooth whorls, 0.73 mm wide, 0.51 mm high. 8 teleoconch whorls. Suture distinct, slightly impressed. Upper third of whorls smooth, then strong axial ribs develop and continue to lower suture. Ribs narrow, reach maximum extent at midwhorl, then taper to lower suture. Ribs absent on body whorl. Numerous very fine spiral striae and axial growth lines on entire shell surface. Strong varix on left side of body whorl. Outer lip slightly thickened, strongly incurved, stromboid notch small but distinct. Sinus very deep, U shaped, on upper shoulder, at 30° angle to shell, margins elevated. Callus low, indistinct. Aperture narrow, deep, elongate. Columella broad, margin elevated. Anterior truncate, canal broad, medium depth, anterior notched. Shell colour uniform chalky white.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Holotype	17.3	7.2	7.0	0.42	0.40

Location of type

Holotype, WAM 211-90.

Type locality

201 m depth, 210 km N of Port Hedland, Western Australia. 18°25'S; 118°22'E.

Material examined

Holotype.

Distribution

Known only from the type locality.

Remarks

Plagiostropha sinecosta is the fifth species of the genus, the other four being *P. opalus* (Reeve, 1843), *P. ebur* (Reeve, 1843), *P. quintupex* Melvill, 1927, and *P. flexus* (Shuto, 1983). *Plagiostropha sinecosta* is clearly congeneric with the other four species on the basis of its biconic shape, strong varix on the left side of the body whorl, lack of strong ribbing on the body whorl, very deep sinus, reflected lip, narrow aperture and truncated body whorl. It differs from all other *Plagiostropha* in having small axial ribs but lacking the strong pentagonal axial ribbing.

Etymology

A combination of *sine*, meaning without, and *costa*, meaning ribs, referring to the lack of the five pronounced axial ribs found on other members of the genus.

Genus *Tylotiella* Habe, 1958

Habe, 1958: 52. Type: OD *Drillia subobliquata* E. A. Smith, 1879. Powell, 1966: 72. Shuto, 1975: 165. Kilburn, 1988: 187-201.

Shell

Shell small, 24 mm or less, claviform, narrow, high spire. Up to 8 teleoconch whorls. Strong sculpturing of up to 18 axial ribs which extend suture to suture, lack

spines. Sculpturing of fine axial and spiral lirae. Varix near outer lip. Sinus deep, callus heavy. Aperture rectangular. Anterior canal short, broad, slightly notched. Radula drilliline. Indo-West Pacific. Recent.

Remarks

Shuto (1975) provided information on the type species of *Tylotiella*, *Drillia subobliquata* Smith, 1879. Powell (1966) and Kilburn (1988) considered *Tylotiella* to be separable from *Clavus* on the basis of having a narrower shell with a tall spire and axial ribs that do not develop spines but which reach the suture, but Kay (1979) regarded *Tylotiella* as a subgenus of *Clavus*.

Tylotiella pica (Reeve, 1843)

Plate 6, Figures 7,8.

Pleurotoma pica Reeve, 1843: pl. 8, fig. 61. Reeve, 1843: 181.

Pleurotoma (Crassispira) pica (Reeve). Weinkauff, 1876: 93, pl. 20, fig. 2.

Drillia (Crassispira) pica (Reeve). H. and A. Adams, 1858: 91.

Drillia pica (Reeve). Tryon, 1884: 190, pl. 13, fig. 50.

Drillia (Clavus) pica (Reeve). Bouge and Dautzenberg, 1914: 141.

Tylotiella pica (Reeve). Powell, 1966: 72.

Shell

Shell of medium length, 24 mm, heavy, high spire. Protoconch broken off in all three syntypes; 7-8 teleoconch whorls. Suture nearly straight, may be indistinct on upper whorls. 18 low, thin axial ribs/whorl, sinuous, extend from suture to suture with an upper and slightly larger lower peaks. Upper part of lower whorls tends to be flat or have indistinct ribs, usually matching on adjacent whorls. Ribs extend well down body whorl but are replaced by 7 distinct spiral striae at base of whorl. Penultimate rib strong, forms varix; final rib smaller, outer lip thickened and extends beyond rib. Numerous fine axial and spiral lirae present. Columella very broad, callused. Sinus deep, cut off from upper side by heavy callus. Aperture rectangular. Anterior canal short, broad, slightly indented. Colour off-white with broad light brown band across centre of body whorl. Band incomplete on upper whorls, forms blotches. Up to 5 thin, spiral brown lines on body whorl, indistinct on upper whorls.

Measurements

	Length (mm)	Width (mm)	Aperture (mm)	W/L	A/L
Syntypes	23.7	9.4	8.7	0.40	0.37
	21.8	8.5	7.9	0.39	0.36
	21.2	8.4	8.3	0.40	0.39

Location of types

Syntypes, 3 specimens. BM(NH) 1963875.

Type locality

Capul I., Philippines.

Material examined

Syntypes. Christmas I. (Indian Ocean) (WAM); Mururoa Atoll, Tuamotu Arch. (AIM); New Caledonia: Lifu (AIM); Noumea (AIM); Japan (2 AIM); PNG: 24 m, Raluana Village, E New Britain I. (AIM).

Other records

Cernohorsky (1978): Indo-West Pacific. Wells *et al.* (1990): Christmas I. Springsteen and Leobrera (1986): Philippines.

Distribution

Indo-West Pacific; Christmas Island, Indian Ocean.

Remarks

This species has not yet been recorded from the coastline of the Australian mainland, but has been found at the Australian territory of Christmas Island in the Indian Ocean.

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The late Dr. A. W. B. Powell of the Auckland Institute and Museum was in the process of revising the Indo-Pacific Turridae before he retired. After a draft of this paper was written I was fortunate enough to see a draft manuscript of the Clavinae written by Dr. Powell, probably in the early 1960's. I have benefited from being able to compare my opinions with Powell's but of course I am responsible for any errors I may have made.

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